

EXECUTIVE SUMMARY

The Ross Metals Site (herein after referred to as "the RM site" or "the site") operated as a secondary lead smelter from 1978 to 1992, during which time the facility processed spent lead-acid batteries, lead dross, lead scrap, and other lead bearing material into reusable lead alloy. The site is located in a rural, residential area of Rossville, Fayette County, Tennessee. The site includes the process area, an unlined landfill containing about 10,000 cubic yards (CY) of blast slag located north of the process area, as well as contaminated wetlands located north and east of the process area and landfill. In addition, about 6,000 CY of stockpiled slag is stored on site in several deteriorating buildings. Lead-contaminated surface soil is located throughout the site, and lead-contaminated subsurface soil is present in isolated portions of the site.

The U.S. Environmental Protection Agency (EPA) developed an Engineering Evaluation/Cost Analysis (EE/CA) for the site based on data from previous investigations, including investigations conducted by EPA Region 4 in November 1996 and May 1997. One of the objectives of the EE/CA was to provide a framework for evaluating and selecting alternative technologies that could be used in developing a non-time critical removal action for the site. However, the EE/CA focused only on the process area and landfill. The contaminated wetlands north and east of these areas were not considered. In considering the information presented in the EE/CA and the statutory limits which apply to non-time critical removal actions, EPA determined that a remedial investigation /feasibility study (RI/FS) report that develops appropriate remedial action alternatives was needed for the site.

In April 1998, CDM Federal Programs Corporation (CDM Federal) was tasked by EPA to develop an RI/FS Report for the site by using the information provided in the EE/CA and other site reports under Contract No. 68-W9-0056. The purpose of this RI/FS is to document the nature and extent of contamination at the RM site and to develop and evaluate remedial alternatives, as appropriate.

Results of previous investigations that were used to develop this RI/FS show that lead-contaminated surface soil is present across the site. Lead concentrations in most surface soil and sediment samples collected throughout the site exceeded 400 ppm. In addition, aluminum, antimony, arsenic, barium, cadmium, copper, iron, manganese, selenium, and vanadium were detected above risk-based remedial goal option (RGO) levels. In addition, high levels of subsurface soil contamination were found in two isolated locations in the process area; east of the wrecker building, and southeast of the truck wash.

Analytical results of groundwater samples revealed the presence of several inorganic compounds at concentrations that either exceed the primary or secondary drinking water standards or the State of Tennessee domestic water supply criteria. Aluminum, arsenic, barium, cadmium, chromium, iron, lead, manganese, nickel and vanadium were detected above respective guidance concentrations and/or RGO levels. Analytical results of surface water samples revealed concentrations of several inorganic compounds that exceeded background concentrations. Significant inorganic contaminants included antimony, arsenic, cadmium, iron, lead, and manganese.

As a result of the baseline risk assessment (BRA) completed for the RI, COCs were defined for soil and groundwater. For the protection of human health, aluminum, antimony, arsenic, barium, cadmium, copper, iron, lead, manganese, selenium, and vanadium were defined as soil COCs. Groundwater COCs include aluminum, arsenic, barium, cadmium, chromium, iron, lead, manganese, nickel, and vanadium.

The ecological risk assessment conducted for the RM site identified wetlands north and east of the facility, as well as the facility itself, as areas of concern and evaluated the degree of contamination in wetlands farther from the facility that had not been previously evaluated. The ecological risk assessment concluded that of the metals calculated to pose a potential risk, lead posed the highest risk to the ecological risk receptors at the site.

Results from previous investigations suggest that lead will be the "driver" in any remediation effort conducted at the site. The presence of lead is sufficiently widespread that gearing a remediation effort to lead will also remediate other COC contamination, meaning that the extent of lead contamination serves as a good indicator of the extent of all the COC contamination at the RM site.

The primary objectives of the FS completed for the RM site were to support the identification of remediation goals for the media that have been identified as contaminated, to determine the extent of contamination above the remediation goals, to develop general response actions (GRAs), to identify, screen, and select remedial technologies and process options applicable to the contamination associated with the RM site, and to develop and analyze possible remedial action alternatives for the site.

Using the volumes of contaminated media calculated for the EE/CA and wetlands restoration, GRAs were identified. The most appropriate technologies applicable to the contamination at the site were chosen for each of the GRAs. Specific process options were then selected to represent those technologies. Remedial action alternatives were formulated considering the extent of contamination, contaminant type, contaminant concentrations, and applicable technologies. Six surface soil alternatives, three wetland sediment alternatives and three groundwater alternatives underwent a detailed evaluation on the basis of overall protection of human health and the environment, long-term effectiveness, compliance with ARARs, reduction of mobility, toxicity, and volume (M/T/V) through treatment, short-term effectiveness, implementability, and cost. A summary of this evaluation is presented in **Tables ES-1 through ES-3**.

The developed alternatives give decision makers a range of potential actions that could be taken to remediate this site. Actions for surface soil include:

- Alternative 1 No Action
- Alternative 2 Capping
- Alternative 3 Capping with Pavement in Place

Table ES-1

Summary of Soil Alternatives Evaluation
Ross Metals Site
Rossville, Tennessee

Remedial Alternative	Threshold Criteria		Reduction of M/T/V Through Treatment	Short-Term Effectiveness	Balancing Criteria		Cost Worth
	Overall Protection of Human Health and the Environment	Compliance with ARARs			Technical/Engineering Considerations	Estimated Time for Implementation (years)	
1 -- No Action	Does not eliminate exposure pathways or reduce the level of risk. Does not limit migration of or remove contaminants.	Chemical-specific ARARs are not met. Location- and action-specific ARARs do not apply.	The contaminated material is a long-term impact. The remediation goals are not met.	No reduction of M/T/V is realized.	Level D protective equipment is required during sampling.	<1	\$100,247
2 -- Capping	Eliminates exposure pathways and reduces the level of risk. Isolates contamination and minimizes further migration.	All action-specific ARARs are expected to be met. Location-specific ARARs are applicable and would need to be met.	Long-term public health threats associated with surface soil and sediment are greatly reduced. No residual risks from the alternative. Long - term effectiveness requires cap maintenance	Reduction of mobility is realized but contaminant volume or toxicity are not reduced. For the principal threat waste at the site, does not meet EPA's expectation to treat principal threat waste.	Level C and D protective equipment required during site activities. Excavating and grading may result in potential release of dust. Noise nuisance from use of heavy equipment.	<1	Opt.1-\$1,735,804 Opt.2-\$1,712,412
3 -- Capping With Pavement In Place	Eliminates exposure pathways and reduces the level of risk. Isolates contamination and minimizes further migration.	All action-specific ARARs are expected to be met. Location-specific ARARs are applicable and would need to be met.	Long-term public health threats associated with surface soil and sediment are greatly reduced. No residual risks from the alternative. Long - term effectiveness requires cap maintenance	Reduction of mobility is realized but contaminant volume or toxicity are not reduced. For the principal threat waste at the site, does not meet EPA's expectation to treat principal threat waste.	Level C and D protective equipment required during site activities. Excavating and grading may result in potential release of dust. Noise nuisance from use of heavy equipment.	<1	Opt.1-\$1,453,803 Opt.2-\$1,430,411
4 -- Capping With Construction of Above-Ground Disposal Cell	Eliminates exposure pathways and reduces the level of risk. Isolates contamination and minimizes further migration.	All action-specific ARARs are expected to be met. Location-specific ARARs are applicable and would need to be met.	Long-term public health threats associated with surface soil and sediment are greatly reduced. No residual risks from the alternative. Long - term effectiveness requires cap maintenance	Reduction of mobility is realized but contaminant volume or toxicity are not reduced. For the principal threat waste at the site, does not meet EPA's expectation to treat principal threat waste.	Level C and D protective equipment required during site activities. Excavating and grading may result in potential release of dust. Noise nuisance from use of heavy equipment.	<1	Opt.1-\$1,506,847 Opt.2-\$1,481,865

Note: Option 1 - volumes include excavated wetland sediment; Option 2 - wetland sediment not included in volumes

Table ES-1(cont)

Remedial Alternative	Threshold Criteria		Balancing Criteria			Cost Approx. Total Present Worth
	Overall Protection of Human Health and the Environment	Compliance with ARARs	Long-Term Effectiveness and Permanence	Reduction of M/T/N Through Treatment	Short-Term Effectiveness	
5A -- Excavation and Onsite Treatment With Solidification/ Stabilization and Onsite Disposal	Eliminates exposure pathways and reduces the level of risk. Immobilizes contamination and eliminates further migration.	Chemical-specific ARARs are met. Location- and action-specific ARARs are applicable and would need to be met.	Long-term public health threats associated with surface soil and sediment are eliminated. No residual risks from the alternative. Requires effective cap maintenance.	Mobility and toxicity are reduced, however, treatment process will increase volume. Meets EPA expectation to treat principal threat waste, but also treats (rather than contains) low-level threat wastes.	<1	Capping in a floodplain. Opt.1-\$4,907,274 Opt.2-\$4,244,992
5B -- Excavation and Onsite Treatment With Solidification/ Stabilization and Offsite Disposal	Eliminates exposure pathways and greatly reduces the level of risk. Removes contamination and mitigates further migration.	ARARs are met through onsite treatment and offsite disposal.	Long-term public health threats associated with surface soil and sediment are eliminated. No residual risks from the alternative.	Mobility and toxicity are reduced, however, treatment process will increase volume. Meets EPA expectation to treat principal threat waste, but also treats (rather than contains) low-level threat wastes.	<1	Capping in a floodplain. Opt.1-\$7,477,199 Opt.2-\$6,181,160
6A -- Capping With Excavation and Onsite Treatment And Disposal Of Principal-Threat Waste	Eliminates exposure pathways and greatly reduces the level of risk. Removes contamination and mitigates further migration.	Chemical-specific ARARs are met. Location- and action-specific ARARs are applicable and would need to be met.	Long-term public health threats associated with surface soil and sediment are eliminated. No residual risks from the alternative. Requires effective cap maintenance.	Mobility and toxicity are reduced, however, treatment process will increase volume. Meets EPA expectation to treat principal-threat waste and contain low-level threat waste.	<1	Capping in a floodplain. Opt.1-\$3,175,137 Opt.2-\$2,729,543
6B -- Capping With Excavation and Onsite Treatment And Offsite Disposal Of Treated Principal-Threat Waste	Eliminates exposure pathways and greatly reduces the level of risk. Removes contamination and mitigates further migration.	Chemical-specific ARARs are met. Location- and action-specific ARARs are applicable and would need to be met.	Long-term public health threats associated with surface soil and sediment are eliminated. No residual risks from the alternative. Requires effective cap maintenance.	Mobility and toxicity are reduced, however, treatment process will increase volume. Meets EPA expectation to treat principal-threat waste and contain low-level threat waste.	<1	Capping in a floodplain. Opt.1-\$4,936,044 Opt.2-\$4,013,508

Note: Option 1 - volumes include excavated wetland sediment; Option 2 - wetland sediment not included in volumes

Table ES-2

Summary of Wetland Sediment Alternatives Evaluation
Ross Metals Site
Rossville, Tennessee

Remedial Alternative	Threshold Criteria		Balancing Criteria			Cost Worth		
	Overall Protection of Human Health and the Environment	Compliance with ARARs	Long-Term Effectiveness and Permanence	Reduction of M/T/V Through Treatment	Short-Term Effectiveness		Technical/Engineering Considerations	Estimated Time for Implementation (years)
1 -- No Action	Does not eliminate exposure pathways or reduce the level of risk. Does not limit migration of or remove contaminants.	Chemical-specific ARARs are not met. Location- and action-specific ARARs do not apply.	The contaminated material is a long-term impact. The remediation goals are not met.	No reduction of M/T/V is realized.	Level D protective equipment is required during sampling.	None	<1	\$100,247
2 -- Capping w/Clean Fill and Off-site Creation of Wetlands	Potentially eliminates multiple exposure pathways to ecological receptors. Organisms utilizing portions of the wetlands below the surface may potentially continue to be exposed.	Does not meet ARARS for protection of wetlands.	Will reduce or eliminate viable exposure pathways and prevent degradation of adjacent wetlands. No residual risks from the alternative. Long -term effectiveness requires cap maintenance	Reduction of mobility is realized but contaminant volume or toxicity are not reduced. For the principal threat waste at the site, does not meet EPA's expectation to treat principal threat waste.	Level C and D protective equipment required during site activities. Grading may result in potential release of dust. Noise nuisance from use of heavy equipment.	Capping in a floodplain and wetlands.	<1	\$611,762
3 A -- Excavation and Revegetation/ Restoration of Wetlands and Regrading with Clean Fill	Eliminates exposure pathways and reduces the level of risk. Removes contamination and restores functional value of contaminated wetlands.	All action-specific ARARs are expected to be met. Location-specific ARARs are applicable and would need to be met.	Long-term ecological threats associated with sediment are greatly reduced. No residual risks from the alternative. Long -term effectiveness requires cap maintenance	Reduction of mobility, toxicity, and volume is achieved through removal, not treatment.	Level C and D protective equipment required during site activities. Excavating and grading may result in potential release of dust. Short-term impacts to the wetlands from excavating activities will occur.	None.	<1	\$780,071
3 B -- Excavation and Revegetation/ Restoration of Wetlands and Regrading with Biosolid Compost	Eliminates exposure pathways and reduces the level of risk. Removes contamination and restores functional value of contaminated wetlands.	All action-specific ARARs are expected to be met. Location-specific ARARs are applicable and would need to be met.	Long-term ecological threats associated with sediment are greatly reduced. No residual risks from the alternative. Long -term effectiveness requires cap maintenance	Reduction of mobility, toxicity, and volume is achieved through removal, not treatment. Additionally, use of biosolid compost reduces toxicity by limiting bioavailability of contaminants.	Level C and D protective equipment required during site activities. Excavating and grading may result in potential release of dust. Short-term impacts to the wetlands from excavating activities will occur.	None.	<1	\$699,548

Table ES-3
Summary of Groundwater Alternatives Evaluation
Ross Metals Site
Rossville, Tennessee

Remedial Alternative	Threshold Criteria		Balancing Criteria		Cost Approx. Total Present Worth
	Overall Protection of Human Health and the Environment	Compliance with ARARs	Long-Term Effectiveness and Permanence	Reduction of M/T/V Through Treatment	
1 -- No Action	Does not eliminate exposure pathways or reduce the level of risk. Does not limit migration of or remove contaminants.	Chemical-specific ARARs are not met. Location- and action-specific ARARs do not apply.	The contaminated groundwater is a long-term impact. The remediation goals and MCLs are not met.	No reduction of M/T/V is realized.	Level D protective equipment is required during sampling. None
2 -- Limited Action	Unless contingency component is implemented, does not eliminate exposure pathways. Minimally reduces the level of risk.	Chemical-specific ARARs are not met. Location- and action-specific ARARs do not apply unless contingency component is implemented.	The contaminated groundwater is a long-term impact. The remediation goals and MCLs are not met.	No reduction of M/T/V is realized, unless contingency component is implemented.	Level D protective equipment is required during sampling. Additional data collection needed to determine aquifer characteristics and vertical extent of contamination. Treatment study may be needed to develop contingency treatment component. <1
3 -- Pump & Treat With Physical and/or Chemical Treatment	Eliminates exposure pathways and reduces the level of risk. Reduces contamination and eliminates further migration.	Chemical-specific ARARs are met. Location- and action-specific ARARs are applicable and would need to be met.	Long-term public health threats associated with groundwater are eliminated. No residual risks from the alternative.	Mobility, toxicity and volume are reduced. Level C and D protective equipment required during site activities. Excavating and grading may result in potential release of dust. Noise nuisance from use of heavy equipment.	Additional data collection required to determine aquifer characteristics and vertical extent of contamination. Treatment study may be needed to define treatment component. 5-12

A-- \$1,359,116
B-- \$1,185,719
C-- \$867,484
D-- \$1,652,450

- Alternative 4 Capping with Construction of Above-Ground Disposal Cell
- Alternative 5 A/B Excavation and Onsite Treatment with Solidification/Stabilization
- Alternative 6 A/B Capping with Excavation and Onsite Treatment of Principal Threat Waste

Actions for wetland sediment include:

- Alternative 1 No Action
- Alternative 2 Capping with Clean Fill and Off-site Creation of Wetlands
- Alternative 3 A/B Excavation and Revegetation/Restoration of Wetlands

Actions for groundwater include:

- Alternative 1 No Action
- Alternative 2 Limited Action
- Alternative 3 A/B/C/D Pump & Treat With Physical and/or Chemical Treatment

Finally, **Tables ES-4 through ES-6** present a summary of each remedial alternative along with ranking scores for each evaluation criterion. Each alternative's performance against the criteria (except for present worth) was ranked on a scale of 0 to 5, with 0 indicating that none of the criterion's requirements were met and 5 indicating all of the requirements were met. The ranking scores are not intended to be quantitative or additive, rather they are only summary indicators of each alternative's performance against the CERCLA evaluation criteria. The ranking scores combined with the present worth costs provide the basis for comparison among alternatives.

Table E-4
Comparative Analysis of Soil Alternatives
Ross Metals Site
Rossville, Tennessee

Remedial Alternative	Criteria Rating ¹						Approximate Present Worth (\$)
	Overall Protection of Human Health and the Environment	Compliance with ARARs	Long-Term Effectiveness and Permanence	Reduction of M/T/V Through Treatment	Short-Term Effectiveness	Implementability	
1 -- No Action	0	0	0	0	5	5	\$100,247
2 -- Capping	4	4	2	3	4	3	Opt.1-\$1,735,804 Opt.2-\$1,712,412
3 -- Capping With Pavement In Place	4	4	3	3	4	3	Opt.1-\$1,453,803 Opt.2-\$1,430,411
4 -- Capping With Construction of Above-Ground Disposal Cell	4	4	3	3	4	3	Opt.1-\$1,506,847 Opt.2-\$1,481,865
5A -- Excavation and Onsite Treatment With S/S and onsite Disposal	5	4	4	5	4	3	Opt.1-\$4,907,274 Opt.2-\$4,244,992
5B -- Excavation and Onsite Treatment With S/S and offsite Disposal	5	5	5	5	4	4	Opt.1-\$7,477,199 Opt.2-\$6,181,160
6A -- Capping With Excavation & Onsite Treatment/Disposal of Principal Threat Waste	5	4	4	5	4	3	Opt.1-\$3,175,137 Opt.2-\$2,729,543
6B -- Capping With Excavation & Onsite Treatment and Offsite Disposal of Principal Threat Waste	5	4	4	5	4	3	Opt.1-\$4,936,044 Opt.2-\$4,013,508

¹A ranking of "0" indicates noncompliance, while a ranking of "5" indicates complete compliance.
Note: Option 1 - volumes include excavated wetland sediment; Option 2 - wetland sediment not included in volumes

Table E-5
Comparative Analysis of Wetland Sediment Alternatives
Ross Metals Site
Rossville, Tennessee

Remedial Alternative	Criteria Rating ¹						Approximate Present Worth (\$)
	Overall Protection of Human Health and the Environment	Compliance with ARARs	Long-Term Effectiveness and Permanence	Reduction of M/T/V Through Treatment	Short-Term Effectiveness	Implementability	
1 -- No Action	0	0	0	0	5	5	\$100,247
2 -- Capping with Off-site Creation of Wetlands	3	2	2	3	3	4	\$611,762
3 A -- Excavation, Regrading with Clean Fill and Wetlands Revegetation/ Restoration	5	5	5	4	4	4	\$780,071
3 B -- Excavation, Regrading with Biosolid Compost Material and Wetlands Revegetation/ Restoration	5	5	5	5	4	3	\$699,548

¹A ranking of "0" indicates noncompliance, while a ranking of "5" indicates complete compliance.

Table E-6
Comparative Analysis of Groundwater Alternatives
Ross Metals Site
Rossville, Tennessee

Remedial Alternative	Criteria Rating ¹						Approximate Present Worth (\$)
	Overall Protection of Human Health and the Environment	Compliance with ARARs	Long-Term Effectiveness and Permanence	Reduction of M/T/V Through Treatment	Short-Term Effectiveness	Implementability	
1 -- No Action	0	0	0	0	5	5	\$86,597
2 -- Limited Action	1	0	0	0	5	5	\$498,095
3 A/B /C/D-- Pump & Treat w/ Physical/Chemical Treatment	5	5	5	5	4	4	A-\$1,359,116 B-\$1,185,719 C- \$867,487 D-\$1,652,450

¹A ranking of "0" indicates noncompliance, while a ranking of "5" indicates complete compliance.
Note: Scenarios A,B,C, and D of Alternative 3 represent different system designs ranging from 1 to 15 extraction wells.

Note that the rankings for Groundwater Alternative 3 are based on the results of the original Random-Walk Modeling completed as part of the EE/CA for the RM site. The selection of a specific pump and treat alternative would be based on the outcome of treatability testing and additional modeling to better define aquifer and plume properties, and ensure technical practicability.